Jan Grobovšek on Development Accounting with Intermediate Goods

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Focus paper

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Development Accounting with Intermediate Goods

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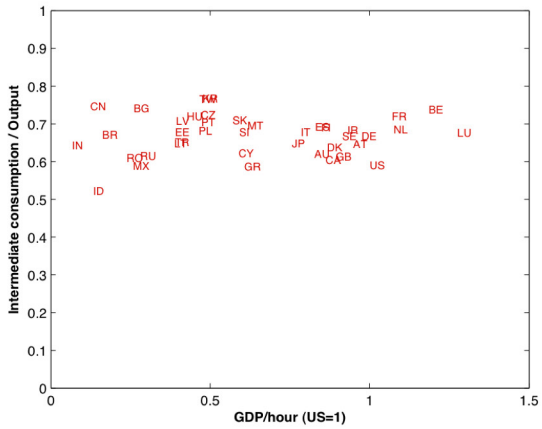
Why are some countries so much less productive than others, as measured by GDP per worker? Much theoretical and empirical work has documented how variations in policies feed into variations in productivity. Shielding monopolies stifles competition and blocks technological adoption; poor enforcement of contracts and property rights discourages financial intermediation, trade and investment; low provision of public goods such as schooling and infrastructure inadequately corrects for market failures. But while many of these individual "institutions" do impact aggregate productivity, they typically do not come anywhere close to generating the order of magnitude *differences in GDP per worker observed between, say, countries such as the U.S. or the U.K., and most of the developing world.*

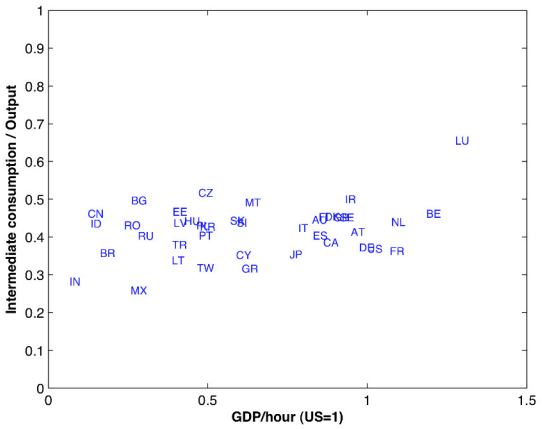
To address this quantitative gap, we use a complementary approach. Instead of modeling the effect of explicit policies we can subdivide the economy into smaller output units to measure which of the bits exhibit the largest productivity differentials in the data. Prominent dichotomies include agricultural vs non-agricultural goods, tradable vs non-tradable goods, or consumption vs investment goods. This diagnostic tool called development accounting is useful for two reasons. First, it allows identifying sectors that are particularly "problematic." Second one can infer how inefficiencies in one sector affect the rest of the economy in equilibrium. For instance, technological progress in agriculture typically induces a decline in food prices. Farmers may then decide to channel more or less available resources such as labor into that activity, thus affecting (productivity) outcomes in other sectors as well.

The present project is a development accounting exercise that explicitly incorporates intermediate inputs. The literature has paid much attention to investment goods but has ignored intermediate inputs, which are in some sense simply investment goods that fully depreciate once they are employed. The framework is as follows. Households allocate consumption between final goods and services. These are manufactured by their respective sector using labor as well as intermediate goods and services, which themselves result from combining labor and intermediate inputs. Altogether there are four sectors producing either goods or services, used for either final or intermediate consumption. Each sector has a unique production function that is identical across countries, save for its level of *efficiency*. Allocations of goods, labor and prices are determined competitively. We then employ this simple framework to ask the following questions.

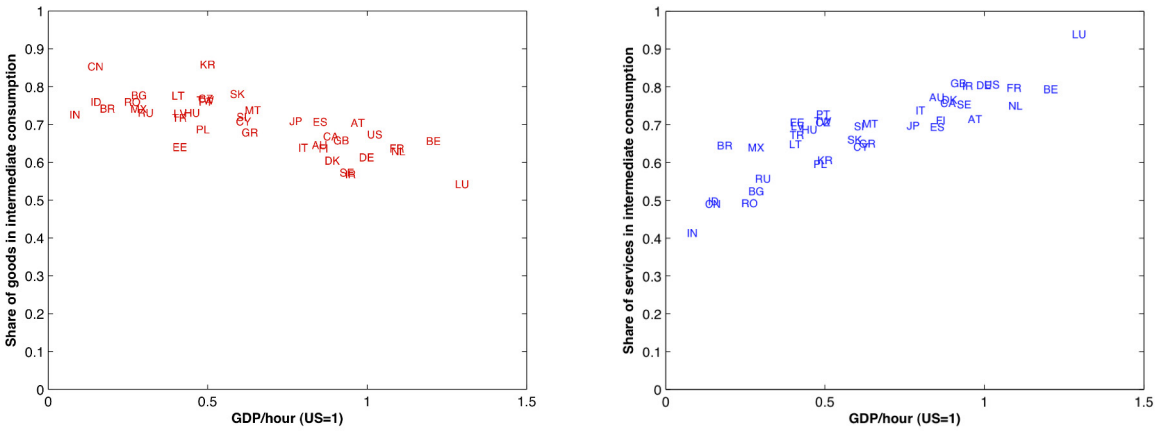
1. ***Which regularities in the data allow us to plausibly parameterize the sector-specific production functions?*** We turn to internationally comparable input-output data to document two novel facts. The first one is that across countries the ratios between intermediate consumption and output are highly constant: per pound of output the goods industry typically spends 0.6 pounds



(A) Goods industry



(B) Service industry



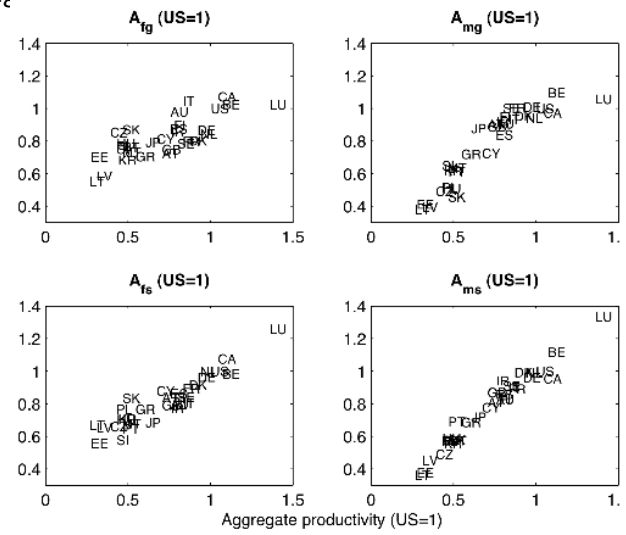
(A) Goods industry (B) Service industry

on intermediates, and the service industry roughly 0.4. The second fact is that the composition of expenditure shares on intermediate goods versus services is not constant: more productive countries typically spend a larger fraction on intermediate services rather than goods. Because in rich countries intermediate goods are cheap relative to services, the two seem to be highly complementary.

2. ***What are the sector-specific efficiencies in each country?*** We set the sectoral efficiency levels so that the model's endogenous outcomes match their counterparts in the data, country by country. First, we use data on a restricted set of countries containing, amongst others, internationally comparable intermediate prices. Poorer countries show up as particularly inefficient at producing intermediate (A_{mg}, A_{ms}) compared to final goods and services (A_{fg}, A_{fs}) – see the figure on the right. We also find – surprisingly – that poorer countries are *not* more inefficient at producing goods than services. Second, we use data for a larger set of countries which, unfortunately, does not allow distinguishing between intermediate and final production efficiency. Again, poorer countries are, by and large, equally inefficient at producing goods and services. How do we square this with the fact that final services, relative to goods, are substantially cheaper in poor versus rich economies? The key lies in the intermediate input intensity – an inefficient economy renders intermediates expensive with respect to labor, which hurts goods industries more than service industries. That mechanism is of course even more pronounced when intermediate production is exceptionally inefficient.

3. ***How would economy-wide outcomes change if countries raised their sectoral efficiency?*** Our particular interest is in evaluating the impact of counterfactual experiments on the GDP per worker of the poorest countries in the sample. We find that raising intermediate input efficiency matters most. It is associated with quite a strong multiplier effect due to the high intermediate input intensity that we measure. Yet, we also find that complementarities between sectors are strong: raising any one sector's efficiency level at a time while keeping the others constant will not be enough to close the productivity gap across countries. Rather, efficiency would need to increase across the board. The flipside of that result is that the average efficiency differential of poor versus rich countries is not nearly as large as the one in aggregate productivity. For instance, countries with a 45% average efficiency level of the richest countries feature only 20% of their aggregate productivity.

Two general conclusions can be drawn that are relevant for both research and policy on growth and development. The first is that institutions generating relatively minor inefficiencies may show up as large productivity drops once input-output linkages are taken into account. The second message is that goods industries – as opposed to service industries – do not call for particular attention. Rather, the focus of developing countries should be on understanding which institutions are pernicious to the production and flow of intermediate (as opposed to final) products. Examples include barriers to international trade in intermediate inputs; poor contract enforcement between buyers and suppliers of intermediates; inefficiencies in publicly provided intermediates such as energy or transportation.



Efficiency levels across sectors